

What is claimed is:

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1. A protective membrane-equipped composite electrolyte for transporting ion from a first electrode to a second electrode of a pair of electrodes provided for an electrochemical cell, wherein a composite electrolyte, which includes a matrix impregnated with a liquid electrolyte, has a surface coated with a membrane composed of crosslinked polymer.

2. The protective membrane-equipped composite electrolyte according to claim 1, wherein said liquid electrolyte is any one of phosphoric acid, sulfuric acid, and methanesulfonic acid, and said membrane is composed of a basic polymer having a structural unit of monomer of secondary amine.

3. The protective membrane-equipped composite electrolyte according to claim 2, wherein said basic polymer is crosslinked by a crosslinking agent containing two or more isocyanate groups.

4. The protective membrane-equipped composite electrolyte according to claim 1, wherein said matrix is composed of a polymer, and said membrane is formed by crosslinking said polymer for constructing said matrix.

5. The protective membrane-equipped composite electrolyte according to claim 4, wherein said liquid electrolyte is any one of phosphoric acid, sulfuric acid, and methanesulfonic acid, and said membrane is composed of a basic polymer having a structural unit of monomer of secondary amine.

6. The protective membrane-equipped composite electrolyte according to claim 5, wherein said basic polymer is crosslinked by a crosslinking agent containing two or more isocyanate groups.

7. A fuel cell provided with a cell unit comprising an electrolyte-electrode joined unit including a protective membrane-equipped composite electrolyte which is composed of a matrix impregnated with a liquid electrolyte and which has a surface coated with a crosslinked polymer membrane, said protective membrane-equipped composite electrolyte being interposed between an anode electrode and a cathode electrode each having a gas diffusion layer and an electrode catalyst layer stacked on said gas diffusion layer.

8. The fuel cell according to claim 7, wherein said liquid electrolyte for constructing said protective membrane-equipped composite electrolyte is any one of phosphoric acid, sulfuric acid, and methanesulfonic acid, and said membrane is composed of a basic polymer having a

structural unit of monomer of secondary amine.

5 9. The fuel cell according to claim 8, wherein said membrane for constructing said protective membrane-equipped composite electrolyte is formed by crosslinking said basic polymer with a crosslinking agent containing two or more isocyanate groups.

10 10. The fuel cell according to claim 7, wherein said matrix for constructing said protective membrane-equipped composite electrolyte is composed of a polymer, and said membrane is formed by crosslinking said polymer for constructing said matrix.

15 11. The fuel cell according to claim 10, wherein said liquid electrolyte for constructing said protective membrane-equipped composite electrolyte is any one of phosphoric acid, sulfuric acid, and methanesulfonic acid, and said membrane is composed of a basic polymer having a structural unit of monomer of secondary amine.

20 12. The fuel cell according to claim 11, wherein said membrane for constructing said protective membrane-equipped composite electrolyte is formed by crosslinking said basic polymer with a crosslinking agent containing two or more isocyanate groups.

13. A method for producing a protective membrane-equipped composite electrolyte, comprising the steps of:

compositing a matrix and a liquid electrolyte by impregnating said matrix with said liquid electrolyte to prepare a composite electrolyte;

depositing a crosslinkable polymer onto a surface of said composite electrolyte together with a crosslinking agent; and

forming a membrane composed of crosslinked polymer by reacting said crosslinkable polymer and said crosslinking agent with each other.

14. The method for producing said protective membrane-equipped composite electrolyte according to claim 13, wherein any one of phosphoric acid, sulfuric acid, and methanesulfonic acid is used as said liquid electrolyte, and a basic polymer having a structural unit of monomer of secondary amine is used as a constitutive material for said membrane.

15. The method for producing said protective membrane-equipped composite electrolyte according to claim 14, wherein a substance containing two or more isocyanate groups is used as said crosslinking agent.

16. A method for producing a protective membrane-equipped composite electrolyte, comprising the steps of:

compositing a matrix and a liquid electrolyte by
impregnating said matrix composed of a polymer with said
liquid electrolyte to prepare a composite electrolyte; and

5 forming a membrane composed of crosslinked polymer on a
surface of said matrix by crosslinking said polymer for
constructing said matrix with a crosslinking agent.

10 17. The method for producing said protective membrane-
equipped composite electrolyte according to claim 16,
wherein any one of phosphoric acid, sulfuric acid, and
methanesulfonic acid is used as said liquid electrolyte, and
a basic polymer having a structural unit of monomer of
secondary amine is used as a constitutive material for said
membrane.

15 18. The method for producing said protective membrane-
equipped composite electrolyte according to claim 17,
wherein a substance containing two or more isocyanate groups
is used as said crosslinking agent.